

THE GUNONG BENOM EXPEDITION 1967

2. AN OUTLINE DESCRIPTION OF THE FOREST ZONES ON NORTH-EAST GUNONG BENOM

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3. BRYOPHYTES AND FILMY FERNS FROM GUNONG BENOM

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2. AN OUTLINE DESCRIPTION OF THE FOREST ZONES ON NORTH-EAST GUNONG BENOM

By T. C. WHITMORE

THE north-east ridge of Gunong Benom provides in a single majestic sweep a fine locus, perhaps the best in Malaya, for the study of the change of forests with elevation. Above about 1000 ft the rock is uniformly granite and the ridge is broad and more or less continuous. Therefore there are no complications introduced by changes in geology or by broken relief.

In 1967 Kepong botanists spent about four weeks plant collecting on Benom, part of the time with the University of Malaya/British Museum (Natural History) Expedition. I myself also made an outline survey of the vegetation types. This I describe here to set the picture for the more particular studies made by the varied groups of zoologists on the Expedition. I hope that publication of this background will stimulate a forest ecologist to visit Benom to make a detailed study of the phenomenon of the altitudinal zonation of tropical forest, for which this mountain is ideally suited.

Tropical rain forest altitudinal zones may be classified in two ways. Firstly we may distinguish Rain Forest Formation Types, defined on structure and physiog-

TABLE I
ALTITUDINAL FOREST ZONES IN MALAYA (AFTER SYMINGTON, 1943)

Malayan floristic zones	Elevation	World-wide structural and physiognomic zones
Lowland Dipterocarp		
-----	c. 1000 ft	Lowland Rain forest
Hill Dipterocarp		
-----	c. 2500 ft	-----
Upper Dipterocarp		
-----	c. 4000 ft	Lower Montane Rain forest
Montane Oak		
-----	c. 5000 ft	-----
Montane Ericaceous		Upper Montane Rain forest

nomy, and recognizable throughout the humid tropics. Secondly we may define zones on flora; these are consequently restricted to a particular country or region. These two classifications run together, as set out in Table 1. Further description of the Formation Types is given in Grubb *et al.* (1963).

The Malayan floristic zones were described and defined by Symington (1943), and have been redescribed and amplified several times by Wyatt-Smith (notably Wyatt-Smith, 1964).

The forest at about 700 ft around Base camp is Lowland Rain forest, and floristically is very rich Lowland Dipterocarp forest. There had been selective logging of the most valuable timber, including many of the dipterocarps, a few months before we visited Benom, so it is no longer easy to give a floristic account of the area. Logging did not extend west of the river Kerau. The area east of the Kerau had relict tall trees isolated or in groups, and the main and lower parts of the forest canopy was variously broken or disturbed by extraction tracks etc.

Before disturbance the original forest had been magnificent, as witnessed by the still standing trees of *Koompassia excelsa* (Leguminosae), with its fluorescent green, smooth trunk and cauliflower-shaped crown, reaching 150 to 200 ft or even taller (Plate 5). Here we felled a relict 150 ft tree which proved to be *Kibatalia arborea*, only otherwise known in Malaya from a few trees at Kepong and one in Ulu Langat. Further details of the flora of this zone can be found through Appendix 1.

In the open places left by timber extraction, for instance around the camp, a dense stand of *Mallotus paniculatus* (Euphorbiaceae) had grown up with some *Sapium* (Euphorbiaceae) and some *Macaranga gigantea* (Euphorbiaceae). In other places dense thickets of gingers and wild banana had sprung up along extraction tracks (Plate 6).

The unfelled forest across the stream was typical of many valley bottoms, some high forest with riverine species, e.g., *Dillenia reticulata*, and some scrub and climber thickets. There was little bamboo. An old *Rafflesia hasseltii* flower was found in one scrub thicket. South of the camp were patches to an acre or so in extent of the scrambling fern *Gleichenia* (*s.l.*) with secondary forest trees growing through; these areas are probably sites of former aborigine cultivation. Although all human settlements were moved a few years ago to Kuala Lompat, outside the Game Reserve, the map given by Ogilvie (1949) shows both Negrito and Jah Chong people on north-east Benom. Similar *Gleichenia* patches and rattan tangles on the steep west slope of the Kerau valley have probably resulted spontaneously from landslips.

Felling had continued, but less intensively, on the hill slope up to camp 2 at 1700 ft. Larger patches of original forest remained, and the track from Base camp ran amongst standing forest giants (Plate 7). Along this track and above camp 2 felling had been restricted to the north side, outside the Game Reserve. Since the Expedition was in the field, extensive felling in 1968 has covered a large area here, up to and abutting on the Game Reserve boundary along the main north-east ridge, and there has been some encroachment.

The undisturbed forest begins almost at once above camp 2. The ridge to camp 2½

(2500 ft) carries very fine Hill and Upper Dipterocarp forest. *Shorea curtisii* (Dipterocarpaceae) is prominent, associated with *Shorea maxwelliana* and a *Swintonia* (Anacardiaceae). Isolated big trees of the conifer *Agathis dammara* were seen. *Eugeissona tristis*, a big undergrowth palm commonly associated with *S. curtisii*, is absent.

Between 2500 ft and 3500 ft a sharp and almost total change in flora occurs. This is associated with a change to Lower Montane Rain forest, within which camp 3 lay. The change in forest type can be clearly seen on aerial photographs.

At camp 3 the forest was described as follows* (and following the scheme in Table 10 in Grubb *et al.*, 1963):

	Broad ridgetop
3500 ft	
Canopy:	70-80 ft, the biggest trees 8-9 ft girth, with tall straight boles, amongst them <i>Adinandra</i> (Theaceae), <i>Santiria rubiginosa</i> (Burseraceae) and <i>Tristania</i> (Myrtaceae) prominent (Plate 8).
Climbers:	Photophytes: none seen. Skiophytes: <i>Freycinetia javanica</i> (Pandanaeae) and another <i>Freycinetia sp.</i> frequent.
Epiphytes:	Vascular: infrequent; non-vascular: 10% thin cover on tree trunks; 20%, or rarely up to 90%, cover up to 6 ft on butts.
Soil:	Continuous leaf litter, over a spongy 6 in. peat layer itself overlying a coarse yellow sandy clay.

The presence of a peat over the mineral soil at an elevation as low as this is noteworthy. Peat was noticed on G. Benom from here to the summit. At camp 4, 5000 ft, it was about 1 ft thick.

The boundary to Lower Montane Rain forest is sharp on G. Benom. With the Lower Montane formation there are local differences in flora. Thus about $\frac{1}{4}$ mile above camp 3, at about 3800 ft where the ridge swings southwards and becomes narrower, the species composition changes and many of the species one sees on the Main Range, e.g. at Fraser's Hill come in. Prominent in the canopy here due to its velvety brown leaves is the new and beautiful *Palaquium regina-montium* (Sapotaceae), an endemic Malayan species now known from several mountains at about this elevation. The conifer *Dacrydium* comes in, as do *Symingtonia populnea* (Hamamelidaceae) and *Weinmannia blumei* (Cunoniaceae). The giant mountain rattan *Plectocomia griffithii*, was seen only in this zone. From about 4000 ft upwards the tallest forest (canopy about 50 ft) with the biggest trees is on broad ridge-crests and on saddles. Narrow exposed ridges carry low Upper Montane Rain forest with gnarled trees. Lower Montane Rain forest persists on gentle slopes and protected valleys to high elevations. In a broad valley about $\frac{1}{4}$ mile south-west of camp 4 at about 4800 ft the flora contained several lowland elements, including new altitude records by a few hundred feet in Malaya for *Knema oblongifolia v. monticola* (Myristicaceae) and *Payena lucida* (Sapotaceae). This valley has a grove of the rare Malayan Maple *Acer caesium*. The boundary between Lower and Upper

* No species list is given, to avoid giving a misleading impression of completeness. Species found at this elevation can be ascertained through appendix 1.

Montane forest, with the former growing high up valleys, is clearly visible on aerial photographs.

Most valley sides and ridge slopes are not gentle, but precipitous and unstable with evidence of land slips. In some places huge boulder piles cover the slopes with caves between and under them. Trees are few and rather small and the undergrowth is very dense with many palm and gingers (Plate 9). Fallen trees are abundant. Many characteristic trees are virtually exclusive to the ridges and do not grow on the unstable boulder littered slopes. Examples are *Ternstroemia* FRI 3320, *Dacrydium comosum* and *D. elatum* and *Podocarpus imbricatus* (Coniferae) and amongst the smaller trees the very lovely pink-flowered *Rhododendron wrayi*.

With increasing elevation one passes through less Lower Montane forest; nearly everywhere is clothed in the Upper Montane formation whose facies and probably species composition varies from place to place, notably with relief.

In places *Baeckia frutescens* (Myrtaceae) and *Leptospermum flavescens* (Myrtaceae) (Plate 10) are abundant. The deep gully at c. 6000 ft below and to the south-west of the first peak on the summit ridge has vestiges of Lower Montane forest. It is the last station of the common undergrowth montane palm *Pinanga polymorpha* and of the rattans (a slender *Calamus*).

The first peak, 6760 ft, has an open stunted Upper Montane forest, (Plate 5) almost a pure stand of 15–20 ft *Leptospermum flavescens* (Plate 11) with a little *Dacrydium* over a grassy, bushy undergrowth in which the trunked sedge *Gahnia baniensis* and *Rhododendron obscurum* are conspicuous (Plate 12). Open turfy places carry *Gentiana malayana* (one of the North Temperate—Himalayan plants which reach into Malesia on high mountains), and the small sedges *Lepidosperma chinense* and *Oreobolus kukenthallii*. The ground is covered by thick peat in which the bogmoss *Sphagnum junghunianum* is prominent.

The flora is much less rich than the similar formation on G. Tahan, with which (and probably other high peaks) it shares most of its species.

Upper Montane Rain forest is characterized *inter alia* by abundant epiphytes. These are far less well developed on Benom than is common. Orchids are uncommon. Above c. 3500 ft tree boles do have a bryophyte layer but it is only c. 1 in. thick. Filmy ferns are inconspicuous. There are no great festoons from the trees even in the moist gullies. The exposed first summit peak has very little bryophyte development indeed.

Slight development of epiphytes and skiophytic climbers as compared with other humid tropical countries seems to be a widespread feature of montane forests of Malaya (see Whitmore & Burnham, 1969, describing G. Ulu Kali in the Main Range). It may reflect the lower rainfall here than elsewhere. G. Benom, lying in the rain shadows of both the Main Range and the east coast mountains, is in a dry part of Malaya and this probably is an important factor limiting the epiphyte flora.

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APPENDIX I

Previous expeditions to Benom have either been by a botanist or with a botanist, and several species lists have been published with the accounts of the ascents to which Medway has referred in his introduction. Our collections, 408 numbers, are the first from the north-east side of the massif, and in total are probably the biggest made on the mountain.

We do not propose to publish a list of the species collected. They are being named in the normal course of our research work, and duplicates have been distributed to our usual correspondent herbaria: Arnold Arboretum, Kew, Leiden, and Singapore.

We keep a herbarium register at Kepong from which at any time the identities of the plants collected may be ascertained. It is thus sufficient to quote the numbers of the plants which were collected on the mountain, and interested persons can then discover identifications from the register.

FRI	3126-3143	}	Coll. T. C. Whitmore
FRI	3150-3445		
FRI	3997-4000		
KEP	97801-97850	}	Coll. Rahim bin Ismail
KEP	99783-		
KEP	100101-100129	}	Coll. Zahir bin Yusof
KEP	99101-99150		
KEP	104301-104313		
KEP	104382-104450	}	Coll. Chelliah